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Complications Of Tads

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ABSTRACT

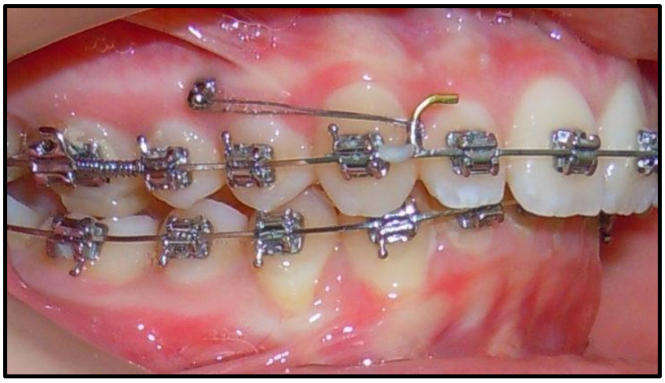
Temporary Anchorage Devices (TADs) have become an important adjunct in modern orthodontic treatment by providing reliable skeletal anchorage with minimal patient compliance. Despite their clinical advantages, various complications may occur during their placement and use. This article aims to review the common complications associated with TADs and their contributing factors. The most frequently reported complications include pain, soft-tissue irritation, inflammation, infection, screw loosening, and failure of primary stability. Root proximity, cortical bone perforation, and improper insertion techniques were also identified as significant risk factors. Patient-related factors such as oral hygiene and bone quality influence success rates. Operator experience and appropriate site selection play a crucial role in reducing complications. Early diagnosis and proper management strategies can improve treatment outcomes. Awareness of potential complications and adherence to correct clinical protocols can enhance the success and predictability of TAD-supported orthodontic treatment

KEYWORDS: Temporary Anchorage Devices, orthodontic mini-implants, complications, skeletal anchorage, stability, anchorage control, TAD failure, root proximity, soft tissue inflammation, peri implant infection, orthodontics biomechanics, risk factors, success rate of TADs**.**

INTRODUCTION

The introduction of TADs has significantly expanded the scope of orthodontic biomechanics, facilitating complex movements such as molar intrusion, en-masse anterior retraction, distalization, protraction, and asymmetric tooth movement, with a high degree of precision6,10,12. Anchorage control—the ability to resist unwanted tooth movement—is a cornerstone of orthodontic treatment planning1,2. Traditionally, anchorage was achieved using adjacent teeth, palatal structures, extraoral appliances (e.g., headgear), or intermaxillary elastics2,3. .

However these methods are often biomechanically limited and heavily reliant on patient cooperation, which may compromise treatment outcomes2,6. Despite their many advantages, TADs are not devoid of complications. A variety of adverse outcomes—including soft tissue irritation, peri-implant inflammation, implant mobility, infection, breakage, and failure of primary stability—can compromise their function and adversely affect treatment results8,9. The success and failure rates of TADs are influenced by numerous variables, such as anatomical location, cortical bone thickness, insertion technique, loading protocol, and patient-related factors, including oral hygiene and systemic health7,8,11.



TADS placed between premolars for the anchorage.

The advent of TADs has rendered many of these traditional methods obsolete, allowing clinicians to achieve anchorage with greater efficiency and minimal reliance on patient adherence6,7,12.

As the use of TADs continues to expand, a comprehensive understanding of the risks, complications, and failure mechanisms associated with these devices becomes essential[7,8,9]. Recognizing and managing complications proactively can significantly improve clinical success rates and patient satisfaction[8,9,11].

This dissertation is undertaken with the aim of providing a comprehensive exploration of the complications associated with Temporary Anchorage Devices, analyzing their causes, evaluating clinical implications, and proposing strategies for prevention and effective management[6,7,8,9].

INDICATION AND CONTRAINDICATION

INDICATIONS-

Molar intrusion.

Molar uprighting by crown distalizing or by root mesializing.

Anterior open bite treatment with molar intrusion (with or without extractions).

Anterior deep bite treatment with incisal intrusion (with or without extractions).

Leveling of transverse tipping of occlusal plane.

Extraction cases.

Distalizing or anchorage after distal movement with other kinds of appliances

Forced eruption of included or non-included teeth

Asymmetric expansion.

Bodily movement of teeth or a group of teeth.

As surgical fixation with lingual brackets.

Absolute anchorage in lingual orthodontics.

They can be used in a growing patient.

Edentulous spaces closure.

Extrusion of impacted Canines

Alignment of Dental Midlines.

Correction of Canted Occlusal Plane

Upper third molar Alignment.

CONTRAINDICATIONS-

Systemic diseases such as diabetes, osteoporosis, osteomyelitis, blood dyscrasias,

metabolism disorders.

Patient undergoing the radiotherapy in arches.

Psychological disorders.

Presence of active oral infections.

Uncontrolled periodontal disease.
Presence of pathological formations in the zone, such as tumors or cysts.
Insufficient space for insertion of microimplant.
Thin cortical bone and insufficient retention.
Deficient quality of the bone.
Soft tissue lesions, such as lichen planus, leucoplakia, etc.
Patient who does not accept microimplant treatment.

CLASSIFICATION

BASED ON COMPOSITION-
Biotolerant-
Stainless steel
Chromium cobalt steel
Bioinert
Titanium
Carbon
Bioactive
Vetaroceramic
Apatite hydroxide
Ceramic oxidised aluminium
Bioresorbable
Polyactide

BASED 0N SHAPE-
A. Cylinderical
B. Tapered
C. Combination

BASED ON SIZE
Length=4-12mm
Diameter=1.15-2.5mm

BASED ON HEAD TYPE
Small head type
No head type
Long head type
Circle head type
Fixation head type
Bracket head type
Hook head type

BASED ON LOCATION
Subperiosteal
Transosseos

BASED ON THE CONGIGURATION DESIGN

Root form implants

Blade/ plate implants

BASED ON THE SURFACE STRUCTURE

Threaded or Non-threaded

Porous or Non porous

BASED ON IMPLANT MORPHOLOGY

Screw type

Disc type

Blade/ plate type

BASED ON THE BIOLOGICAL ADAPTATION AT THE INTERFACE

Implats which osseointergrate

Implants which do not osseointergrate

BASED ON THE LOADING CHARACTERISTICS

Non latency implants

Latency implants

BASED ON ANCHORAGE REQUIREMENT

Direct anchorage

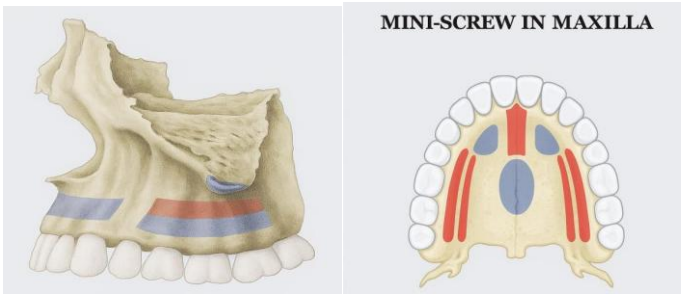
Indirect anchorage

PLACEMENT OF TADS-

PLACEMENT OF MINI-SCREW IN MAXILLA

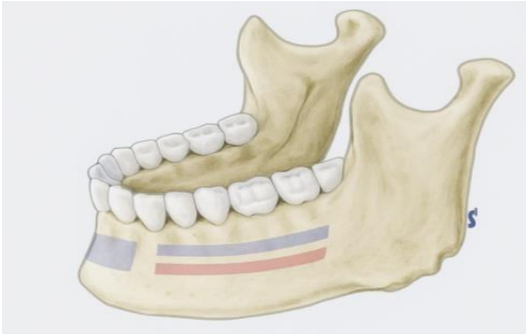
The safe zone are indicated in blue, while the danger zone are indicated in red. Those area which are safe are buccal alveolus, edentulous area, post, anterior alveolus, anterior rugae, maxillary tuberosity.

Those are unsafe is Mid palatal suture, infrazygomatic crest.

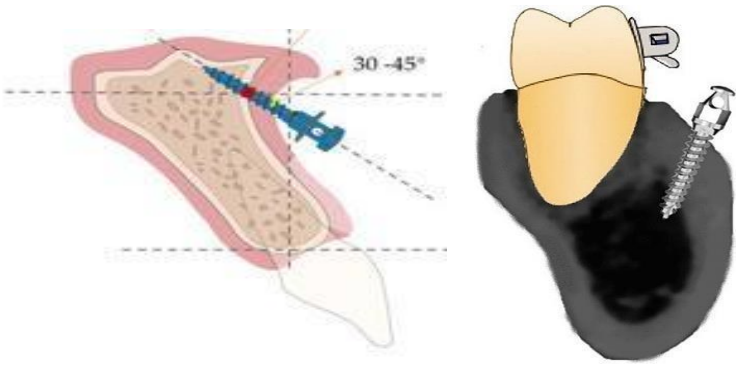


PLACEMENT OF MINI-SCREW IN MANDIBLE

The safe zones are indicated in blue, while the danger zones are indicated in red. Safe zones are Buccal alveolus, Edentulous area, Anterior alveolus,. Danger zone are Retromolar area, Buccal shelf, Lingual alveolus.



Recommended angles of the implant to the long axes of the teeth have ranged from 30-45° in the maxilla and from 10-20° in the mandible.



A:angle of TADS insertion for maxilla, B: angle of TADS insertion for mandible

COMPLICATION OF TADS DURING INSERTION

Trauma to the periodontal ligament or the dental root

Potential complications of root injury include loss of tooth vitality, osteosclerosis, and dentoalveolar ankylosis.

Miniscrew slippage

High risk regions for miniscrew slippage include sloped bony planes in alveolar mucosa such as the zygomatic buttress, the retromolar pad, the buccal cortical shelf, and the maxillary buccal exostosis if present[10,12].

Nerve involvement

Nerve injury can occur during placement of miniscrews in the maxillary palatal slope, the mandibular buccal dentoalveolus, and the retromolar region

Air subcutaneous emphysema

Subcutaneous emphysema can occur during routine operative dental procedures if air from the high-speed or air-water syringe travels under the gingival tissues.

Nasal and maxillary sinus perforation

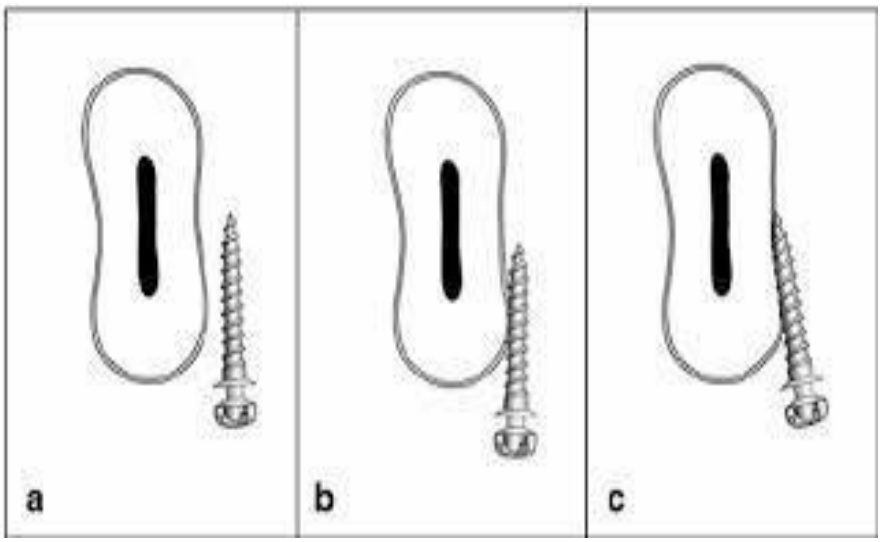
Perforation of the nasal sinus and the maxillary sinuses can occur during miniscrew placement in the maxillary incisal, maxillary posterior dentoalveolar, and zygomatic regions. A posterior atrophic maxilla is a major risk factor for sinus perforation[10].

Miniscrew bending, fracture and torsional stress

Increased torsional stress during placement can lead to implant bending or fracture, or produce small cracks in the peri-implant bone, that affect miniscrew stability.[11]

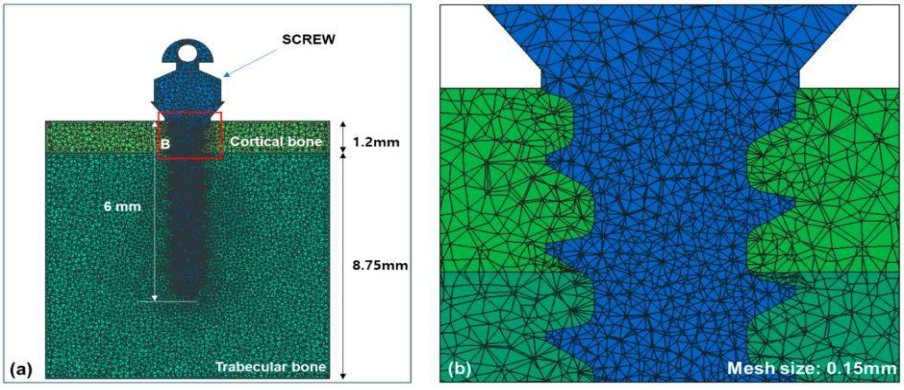
Root contact

Potential complications of root injury include loss of tooth pulp sensibility, root resorption, root fracture, osteosclerosis, and dentoalveolar ankylosis[9].



Cortical bone damage

Extensive osseous microdamage during insertion of orthodontic miniscrew may reduce the stability of immediately loaded miniscrews due to the bone remodeling processes initiated by microdamage. Large diameter miniscrews and overtightening through deep insertion might lead to more significant microdamage to the cortical bone.



COMPLICATION OF TADS UNDER ORTHODONTIC LOADING

Stationary anchorage failure

The key determinant for stationary anchorage is bone density. Stationary anchorage failure is often a result of low bone density due to inadequate cortical thickness[11,12].

Miniscrew migration

Miniscrew migration refers to the gradual or sudden movement of a TAD from its initial insertion site, either within bone or into surrounding tissues, due to mechanical, biological, or anatomical factors.Migration differs from mobility: while mobility indicates loosening without displacement, migration involves positional change.

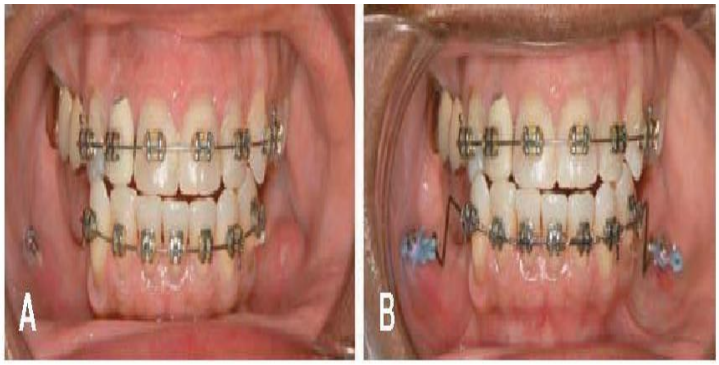
COMPLICATION OF TADS IN SOFT TISSUES

Aphthous ulcer

Minor aphthous ulcerations, or canker sores, can develop around the miniscrew shaft or on the adjacent buccal mucosa in contact with the miniscrew head.

Soft-tissue coverage of the miniscrew head and auxiliary

Soft-tissue coverage might be a risk factor for miniscrew stability. Miniscrew attachments (elastic chain, coil spring) that rest on tissues will likely become covered by tissue. The soft-tissue overlaying the miniscrew is relatively thin and can be exposed with light finger pressure



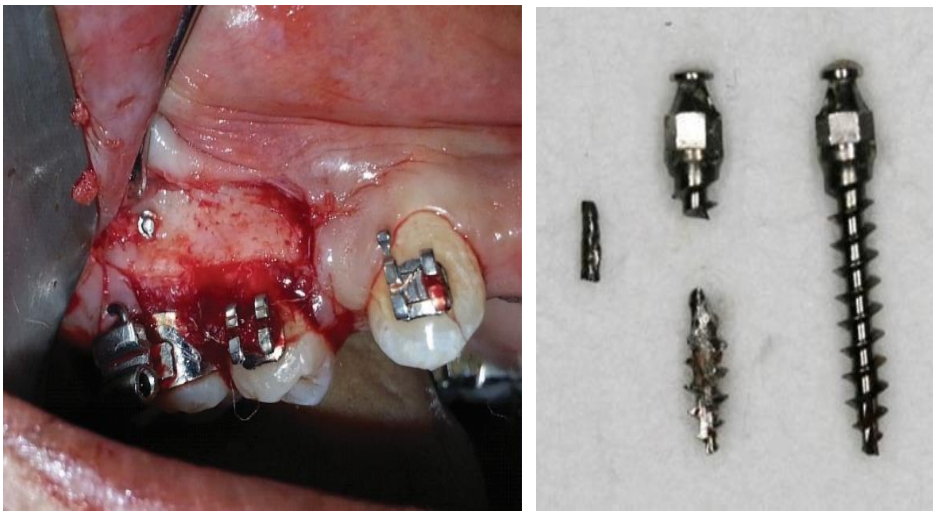
Soft tissue inflammation, infection, and periimplantitis

Peri-implantitis is inflammation of the surrounding implant mucosa with clinically and radiographically evident loss of bony support, bleeding on probing, suppuration, epithelia infiltrations, and progressive mobility.[9]

COMPLICATION OF TADS DURING REMOVAL

Miniscrew fracture

The miniscrew head could fracture from the neck of the shaft during removal. If the miniscrew fractures flush with the bone, the shaft might need to be removed with a trephine[9].



Partial osseointegration

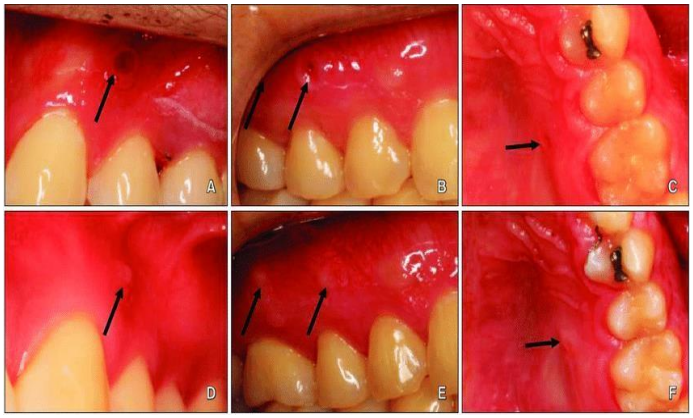
Partial osseointegration refers to the unintended biological integration of the TAD with surrounding bone, leading to difficulty in removal or damage to surrounding tissues[12].

Patient selection and home care

COMPLICATION OF TADS AFTER REMOVAL

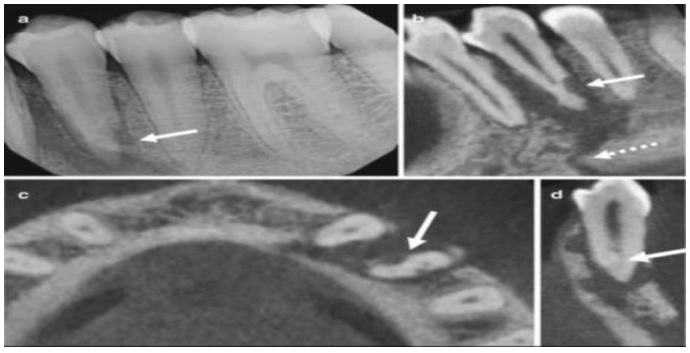
Soft Tissue Scarring

After orthodontic miniscrew removal, detectable soft tissue scarring may develop at a fairly high rate. Even though this scarring was only located at the site of placement and was not considered serious, it might give negative esthetic problems.



Bone and Root Resorption

Miniscrew-assisted intrusion is a risk factor for orthodontically induced inflammatory root resorption; however, a variety of related characteristics (such as insertion site, intrusion site, duration, and magnitude of intrusive force) may have influence on the outcome[9]. The magnitude of intrusive force was associated directly with the root resorption.



Alveolar Bone Exostoses

Alveolar bone exostoses are localized, benign, bony outgrowths that develop on the cortical plate of the alveolar bone. They typically present as hard, nodular swellings covered by intact mucosa and are asymptomatic in most cases.

CONCLUSION

In conclusion, TADs represent one of the most significant innovations in orthodontics, reshaping the way anchorage is achieved and reducing reliance on invasive surgical procedures. While complications are relatively common, they are usually minor, manageable, and transient if identified early and addressed promptly. With continuous refinement in technology and clinical protocols, TADs will continue to expand the orthodontist's armamentarium, marking the beginning of a new era in dentofacial orthopedics and patient-centered orthodontic care.

Looking ahead, advances in TAD design, bioactive surface coatings, and guided insertion techniques promise to further reduce complication rates. Equally, a shift toward patient-centered care—with improved oral hygiene instruction, closer monitoring, and tailored follow-up protocols—will help optimize outcomes.

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